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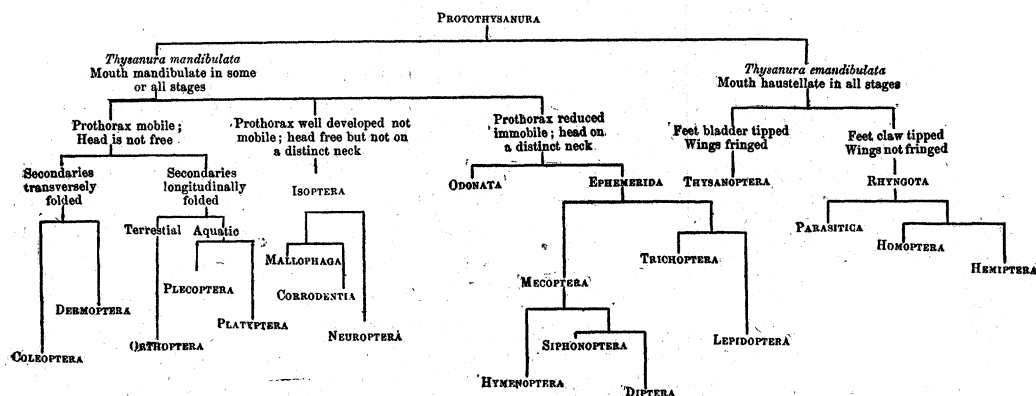
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to me contradicts it more vitally than any other that has been proposed.

I have accorded very little place to the character of the metamorphosis, because there is no hard and fast line between complete and incomplete; but the closer comparative study of early stages will unquestionably help out our future classification. I have not made use of any one character as the basis of my scheme of division, be-

cause I do not think nature works in that way, and finally, I have used adult stages only, because I see in the adult ready to reproduce, the species. It is the culmination of individual growth, and until it is ready to reproduce it is incomplete, subject to change, and not an expression of the point to which its development has attained. In another form my scheme may be expressed as follows:



RUTGERS COLLEGE.

JOHN B. SMITH.

#### HOW MAY MUSEUMS BEST RETARD THE ADVANCE OF SCIENCE?\*

VARIOUS subjects have at various times suggested themselves to me as appropriate for a paper to be submitted to this Association, but when I read the magnificently exhaustive address by Dr. Brown Goode, published in our last Report, it was manifest that all the ideas I had ever had were anticipated in that masterly production. There is, however, one side of our subject which has hardly had the attention paid to it that it undoubtedly deserves. We have been taught how best to arrange our museums for the satisfaction of the collector, of the student, of the investigator, or of the British public, but no one has ever pointed out to us the magnificent opportunities that are at our disposal whereby we may accomplish the great work of retarding the ad-

vance of science. It will perhaps not be wholly waste of time if we devote a few minutes this morning to considering this great power that is in our hands and how we may avail ourselves of it.

There are certain lines of conduct that are so surely and obviously prejudicial to science that the most uninstructed curator scarcely needs to be reminded of them. None of us but has been taught how to bewilder the eyes of the public with thirty specimens of an object, all placed the same way up, and displaying as few of its essential characters as possible, when one specimen properly labelled would have sufficed. We know how to strike dullness through the hearts of thousands by our funereal rows of stuffed birds with their melancholy lines of Latin names; we know how to chill the enthusiasm of the young and to disgust the susceptibilities of tender souls by the

\* From Report of Museum Association for 1896.

display of entrails and abortions stewing in some brown decoction in the depth of antiquated pickle-jars. To suggest such well-known methods to the experienced audience of practical curators before me would be ridiculous and a waste of time. Fortunately there are further means that may be employed, and more subtle actions that may be performed, all tending to the same end.

First let us consider that jealousy with which a museum curator should guard the precious specimens entrusted to his care, forbidding the profane hands of the mere anatomist ever to disturb them in their holy rest. An excellent instance is afforded us by the history of the genus *Spirula*, of which an account has recently been published by Dr. Pelseener in the Report of the 'Challenger' Expedition (Appendix, Zoology, pt. 83). Naturalists for long desired to obtain individuals of this interesting genus for dissection, but only fragmentary specimens came into their hands. At last, in 1865, a complete individual was collected near Port Jackson. The hopes of the naturalist were raised; "*but*," says Pelseener, "but it was deposited in the Sydney Museum, and consequently could not be made the subject of anatomical research." There are other specimens in various public and private collections, notably in London; but they too, like the specimen in the Sydney Museum, cannot be made the subjects of scientific investigation. As curators we must regret that two specimens which were in the hands of a captain of the French navy, who for many years zealously refused to trust them to a zoologist—we must, I say, regret that, in the words of Pelseener, "on the death of their owner, thanks to Professor Giard, these *Spirulae* did not become the prey of a public collection." There are investigators so eaten up with their own conceit as to be bold enough to say that a specimen which shows nothing cannot be hurt by dissection,

since it cannot show less and there is the chance of its showing more. Be not deceived! Do not allow the hidden recesses of your specimens to be explored by the devastating scalpel! What does it matter whether their internal anatomy can be seen or no? They have been entrusted to you for safe preservation, and you as a faithful steward will have to render account of the same.

The exhibition series of a museum are, in their essence, potent agents for retarding the advance of science. By mere force of circumstances, lack of time, undermanning, and so forth, the arrangement of specimens in the show-cases of a museum remains the same throughout many years, and names there applied to genera and species cannot be constantly changed. Classifications come and classifications go, but the classification that was adopted when the museum was built, say fifty years ago, seems likely to go on forever. Possibly even those who are in favor of introducing ideas into our scientific classifications, and who think that the arrangement of species and genera should be in accordance with their affinities and the facts of their structure, and, therefore, should change as our knowledge of that structure increases—even those fanatics, I say, may possibly regard this influence of museums as in some sort a chastening one. After all, it may not conduce to the advancement of science that each of us should have his own special classification and should call animals by his own pet names; and the museum here comes in, like its companion, the text-book, as a maintainer of stability amid the vagaries of ephemeral publication. Still knowledge *does* increase, science *does* advance, and classifications and names unfortunately do change. It is in our power to prevent this knowledge percolating to the mass of the people. If we are unable, like the text-

book writers, to foist upon the public senile illustrations that are nothing better than caricatures, still we can always excuse an effete arrangement or an obsolete nomenclature on the plea that we cannot possibly find the time or the money to re-arrange or re-name the specimens. We can, with much show of justice, refuse to give concrete form to the philosophic ideas of our greatest thinkers. We can refuse to allow our specimens to be experimented with, and arranged this way or that way according as a systematist may desire to check the working-out of his system.

Allied to the natural conservatism of museums is another efficacious practice. It is a well-known story that in the good old days of zoology, when species were regarded as separate creations, a profane sceptic ventured to ask one of our greatest zoologists what he really did manage to do with the connecting links. After looking carefully round the room, the zoologist whispered in reply, "My dear sir, I throw them out of the window." It is these window specimens that form the basis of our theories of evolution. It is by their means alone that we can work out the numerous problems that are pressing on us to-day—the problems of geographical distribution, the problems of heredity and growth, all the vast problems of the origin of our groups of animals. It is these window specimens that the museum curator always has suppressed with a stern hand; may he long continue to do so! How absurd it would be to expect otherwise! Under what names should we enter them in our registers? How could we place them in our cases? Where, indeed, should we find the room for the thousands of variations from the central types that are to be met with in all parts of the world? A museum, being finite, must select more or less, and if we select only those specimens that agree with the diagnoses of authors, we shall be saving both ourselves

and the authors a vast amount of trouble. With regard to the numerous details valued by that exacting creature, the modern biologist—details of locality, of season, or, in the case of fossils, of the definite zonal horizon—it is hardly necessary to add that their accumulation would involve the curator in enormous labor, and if indulged in would probably lead him to the collection of an absurd number of specimens.

All that I have yet said may be summed up in the one phrase 'Shun ideas!' Would it be believed that a certain Professor Herrera, of the National Museum of Mexico, has recently produced a paper in which he says that the museum of the future is to be a museum of ideas? "There will be no gallery of birds, or of mammals, or of fishes, or of reptiles; no collection of Coleoptera, no collection of Chiroptera or of pheasants, or of pigeons. Museums of the future do not classify by classes, families, tribes, genera, species, sub-species, varieties, sub-varieties, races and sub-races; they put in order facts and classify ideas. There are rooms for heredity, for ontogenesis, cœnogenesis, variation, mimicry, the struggle for life, nutrition, and so on. These rooms are arranged in a philosophical order, and in that order they must be visited by the public; to this end there will be barriers suitably disposed. In the museum of the future the specimen is the lacquy of an idea; whereas, in our present museums, ideas are the slaves of specimens. Thus a specimen is not exhibited because it is rare or because it ought to be exhibited; we show the most profound contempt for specimens that are rare, curious or pretty. The museum of the future aims at being, not a magazine of dead lumber eaten by worms, but an open book in which men can read the philosophy of nature." And, after suggesting some ideas that may be exemplified in museums, our author concludes, "but, instead of studying these ideas and exhibit-

ing them in his museum, from time immemorial man has tried to imprison the things of nature in a fixed system, a fixed classification, which is not the whole of science, and which cannot be the nest of the whole of philosophy. Nature, in her vastness, protests against the classifiers; maddened, indignant, despairing, she revolts against routine." What rubbish! How can the curator at £70 a year be expected to have ideas of this kind? And how assuming that he has found the intelligence, how can he spare the time to put them into operation? And what would our Boards of Governors, our Trustees, our Town Councils, say if they went into a museum and found a curator, instead of mounting specimens by the hundred, and making as large a display as possible, calmly sitting at his table reading the 'Origin of Species,' or the latest number of the *Archiv für Entwicklungs-Mechanik*?

*Apropos* of the curator, he has been described, and very rightly, as the soul of the museum. What kind of a soul does the museum want? It is obvious that the curator should not be a scientific man; for if he be he will constantly be led astray from his work of labelling, ticketing, mounting, and so forth, to investigate the relationships, distribution, and what not, of some new species that has come into his hands; or, in tracing out some peculiar facts of anatomical or historical interest, he will waste the time that should be employed in compiling a list either of specimens figured by others or of his own grievances. The function of a curator is to keep his specimens clean, to keep them in order, and to exhibit them in such manner as will satisfy the annual visitation of his Board of Trustees or his Town Council. The motto that the curator should hold before his eyes is that famous one, 'Surtout point de zèle.' It is not for him to add to the stores of the museum by spending his Sun-

days in the country collecting fresh specimens, or his holidays in foreign lands to verify the localities whence specimens have come. It is not long since a paper was read before this very Association, read, I regret to say, by a person for whom I am in some respects responsible, recommending that the museum assistant should be sent out "to collect in the fields, the rocks and the seas," then that he should "study the specimens that he has collected, each of which will have for him an interest and a living history which under present conditions it never has; by their means he will extend the boundaries of knowledge and confirm the foundations of system, so that it is for him an expression of universal thought, and no longer a mechanical device for sorting species into their places. Then, with this vitalized classification, and with some real meaning in his head, he will proceed to prepare his most instructive specimens for exhibition, so that the final result may convey to others something at least of the beauty he himself has found in the world."—So too, at the beginning of the century, P. A. Latreille wrote in Sonnini's edition of Buffon ('Insectes,' I., p. x.) "L'homme, qui n'étudie les Insectes que dans son cabinet, peut être descripteur; mais il ne sera jamais, à ce que je pense, un profond entomologiste." But the curator does not require to be 'un profond entomologiste,' 'un profond géologiste,' 'un profond biologiste,' or anything that remotely resembles a scientific man. The curator should take for his pattern and exemplar the clerk in a dry-goods store.

We turn now to a certain practical detail in the arrangement of our museums, which fortunately seems to commend itself to the outside public who are not scientific people, and especially to the donors of specimens and bequeathers of collections. I mean this idea of keeping certain collections separate according as they happen to have

belonged to some person with a lengthy name, or to have been described by some pottering genius of the locality, or, perhaps, merely to have been presented by some individual, who, because his name was utterly unknown, desired to adopt this method of bringing it into prominence, and laid it down in his will that his specimens were to be known for all eternity as the 'Peter Smith Collection.' This method, at all events, places an insuperable bar in the way of our associating specimens that the student wishes to compare, and enables us to hide from the gaze of the traveling man of science specimens of historic interest that he may have come to our museum on purpose to see. Permit me here to indulge in a fragment of autobiography. Many years ago I journeyed to Strassburg on purpose to examine certain specimens that had been described by Mr. de Loriol. The various curators whom I met at the museum assisted me very willingly throughout three days searching for these specimens, but they could not be found, and I went on my way sorrowing. Arrived at Freiburg, I mentioned the fact to my friend, Professor Steinmann, who suggested that possibly the specimens might have been overlooked as being in the Cartier collection. At considerable expense and inconvenience I, therefore, returned to Strassburg, and, sure enough, there were the specimens carefully obscured. I have known instances of eminent foreigners coming to a great museum in our own country, desirous of inspecting certain remarkable specimens, and, after searching for many hours in the cases, where all logic would lead one to imagine the specimens were, learning at last that they were at the other end of the museum because they had once belonged to some vainglorious amateur, or been described by some muddle-headed genius of the dark ages. Who, after this, can say that such a system is not to be encouraged?

Somewhat akin to the distribution of specimens among various collections, and equally efficacious as a skid on the wheels of science, is the practice that still obtains in the majority of our museums of separating recent and fossil forms. It is necessary that I should say some words about this, because there are in this and other countries certain people who strongly urge the amalgamation of these collections, coming out with such absurd *dicta* as that one specimen should not be separated from another because it happens to be preserved in stone instead of in spirits, maintaining that the evolution of life and the relations of the present to the past are far more easily seen if one has not to walk several hundred yards to see the living ally of a fossil species. They also believe that the zoologists are led into errors through their ignorance of extinct animals, an ignorance largely fostered by the museum custom of keeping them apart; and they deny that the paleontologist can properly understand the fossils with which he deals so long as he is prevented by the assumed necessities of museum arrangement from studying living forms *pari passu*. An intimate friend of my own, who happens to be officially connected with one of our greatest scientific establishments, has privately complained to me that his studies found yet another difficulty in the fact that the books which are supposed to deal with modern life are placed in two or three separate rooms at a considerable distance both from one another, and from the room that contains the books dealing with extinct life. Nor is this all. He adds that, when the necessities of the case compel him, as they often do, to visit one of the other libraries, he is actually scowled at as an intruder by his fellow-workers in that department. It is clear that in the institution to which my friend has the honor to belong the true museum-spirit is still flourishing with vigor. It is this

spirit, this idea of separation, of privacy, and, as it were, personal property, to which the Greeks appropriately applied the term *ιδιωσις*—it is this that we curators must continue to foster, if we are seriously desirous of retarding science.

To carry on the *ιδέα ιδιωτικα*: a Museum should keep itself to itself; it has nothing to do with the Free Library, with the University, or with the Zoological Gardens. Do you wish to be overpowered by a lot of rowdy students coming and pawing over your specimens; or do you, as a peace-loving curator, wish to be dragged off to give an opinion upon some new accession of an animal that is possibly dangerous? Remember, too, that by this cooperation your collections are likely to be increased to an unmanageable extent and your hours of labor will be lengthened without a corresponding rise in salary.

This leads me to consider an exceedingly difficult question—the lending-out of specimens. It is, as you are aware, the rule of the British Museum never to let a single specimen that has once been registered pass outside its walls, except as a donation or an exchange. Other museums are either, as you may prefer to term it, less careful or less miserly. There can be no doubt that science is greatly advanced when a reliable investigator, working in one locality, is able to borrow from the museums of other cities or of other countries specimens that will aid his labors. On the other hand, there is this to be said in favor of the proceeding: that in a large number of cases the specimens that are thus loaned never return to the museum, and ultimately are lost to science. It therefore does not very much matter, so long as, if you lend them, you conveniently forget whither they have been sent, and so long as, if you keep them, you place the necessary obstacles in the way of the investigator.

But it may be retorted to the last argu-

ment: there is another way whereby these difficulties are avoided and science greatly advanced. *Videlicet*, one museum can exchange type-specimens or special collections with another. Such a solution of the problem was laid before us at Dublin by Dr. H. O. Forbes. Now, on this question of the dispersal of types, a conversation that I had with a leading English entomologist impressed me forcibly. New species of insects, he said, are being described at the rate of about 6,000 *per annum*. Those who attempt to coordinate the scattered descriptions cannot possibly do so without comparing the type-specimens. Experience shows it to be impossible for even an expert to draw up a description that shall be accepted as recognizable by another expert. Further, no entomologist of ordinary human powers can retain in his memory the conception of any one species, much less of three or four hundred, sufficiently well for him to compare specimens in one museum with those in another, unless he can set them side by side. For any real advance in this subject, the type-specimens of all the species of a family must be gathered together in one room, so that the specialist may examine and compare them directly. This could be done, either by the various type-specimens being lent for some time to another museum, or by a permanent interchange of specimens—one museum specializing in Hymenoptera, another in Diptera, and so on. The difficulties are felt most strongly in entomology, but they affect ornithology, botany, conchology, and other branches of systematic biology to a marked extent. Obviously, then, we have it in our power to retard the advance of these sciences, or even to check it altogether, by jealously guarding our treasures, either forbidding them to leave their abodes under any circumstances whatever, or cleaving to our type-specimens as to some musty but sacred heirloom, useful only to aliens, but

a tattered badge of pride to ourselves. Here is a weapon, the use of which has far-reaching results that appeal to the imagination with the certain annihilation they inflict. Fellow-curators, grasp your weapon, and, more powerful than Canute, force back the advancing tide!

F. A. BATHER.

BRITISH MUSEUM (NAT. HIST.),  
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*INTERNAL SECRETIONS CONSIDERED IN RELATION TO VARIATION AND DEVELOPMENT.*

THE so-called internal secretions of glands and other organs consist of products manufactured by them and passed back to the blood. Many of these products are known to be of very great importance to the adult organism; it is possible that they may be of no less importance to the developing organism and that we may here find a clue to some of the unsolved problems of development. Internal secretions have probably been longest recognized in case of the reproductive organs. The effects of castration, of non-development or development of these organs are well known. It has also been generally recognized that the influence of these organs depends on substances formed by them and given to the blood. What these substances are is still unknown, but there can be little doubt that their presence determines the development of other organs and characters, the so-called secondary sexual characters. The long recognized healing effect of removal of the ovary in women suffering from soft bones and the subsequent growth of bone and fatty tissue has been the subject of researches by Curatulo and Tarulli.\* These authors concluded that the ovaries produce a substance which oxydizes the organic phosphorus compounds and thus cause their rapid destruction. The removal of the ovaries would seem to remove the destroying substance

\*Phys. Cent. IX.

and hence to cause a deposition of phosphorus, and experiment showed that after extirpation of the ovary the excretion of phosphorus fell off one-half.

Perhaps the best known internal secretion is glycogen. This substance, made by the liver and given to the blood, is used as food by many other organs. Thanks to Hedin, Minkowsky and others, the internal secretion of the pancreas is now known to be a necessity to the organism, for if this organ is extirpated, the animal (mammal) quickly dies from diabetes mellitus. What the active substance is and whether it acts directly on the liver or through the nervous system is not yet decided. Equally important internal secretions are produced by the thyroid and thymus glands and the supra-renal capsules, the complete extirpation of any of which leads to rapid death, though life may be prolonged for a longer or shorter time by feeding the animal with the missing organ or injecting its extract into the system. Very striking is the effect of non-development or over-development of the thyroid on the cranium. The low broad skull of the cretin forms a distinct type, and the rapid change in physiognomy in patients suffering from goitre after the reduction of the thyroid or the injection of thyroïdin is well known. According to Brown-Séquard, the fatal results of extirpation of the kidney are due not to poisoning by urea, but to the lack of an internal kidney-secretion essential in some way to the organism. There can be no doubt that the muscles also form such a secretion, for it has been shown that the excitation of the breathing center on muscular activity is the consequence of some chemical substance given by the muscle to the blood. Perhaps a similar secretion is the ammonia manufactured by the mucous membrane of the stomach and carried to the liver, there to be elaborated into other products. Although such substances have not yet been